22 July 2005

MASTER MANUAL SPRING-RISE ALTERNATIVE:

1. **Description of the Proposal:**
   a. **Number of Rises**:
      One/Two Rises
   b. **Flood Control Targets/constraints**:
      Spring Rise Preclude below 31 MAF system storage.
      Single rise only at 31 MAF to 54.5 MAF system storage and flood control + 6,000 cfs. Single rise can occur at any time during the spring rise period.
      Both first and second rise at system storage greater than 54.5 MAF. Minimal increase in flood control targets. (Flood control targets and system storage tiggers could be adjusted minimally if needed to ensure an acceptable number of spring rises.) Based on the restraints above a single rise would have occurred 38 year out of 100years , two rises would have occurred 58 years out of a 100 years and no spring rise of any type during extreme drought would have occurred four times.
   c. Timing, duration, magnitude, rise and fall rates of Single Rise:
      Timing: First rise would likely coincide with the start of the navigation season (23 March) at system storage between 31 MAF and 54.5 MAF. First rise on 16 March if system storage greater than 54.5 MAF.
      Duration: Six days
      Magnitude: Target plus 6,000 cfs above service level for the peak.
      Rise and Fall: Rising limb of two days at 3,000 cfs per day above service level. Falling limb of four days at 1,500 cfs per day to service level.

   d. **Timing, duration, magnitude, rise and fall rates of Second Rise:**
      Timing: Start second rise June 1. (This start date can be adjusted to reflect the actual antecedent temperature conditions.)
      Duration: Six days
      Magnitude: Flow Service Level Target plus 6,000 cfs. Flood controls not increased or minimal if essential. (Magnitude in the future can be increased or decreased based on best science.)
      Rise and Fall: Rising limb for two days at 3,000 cfs per day. Falling limb for four days at 1,500 cfs per day to service level as per system storage on March 15. (Rise and fall criteria can be decreased or increased base on best science.)

      How does this address water availability? Variation for wet, normal or dry years (including Stop Protocols or precludes): The existing Master Manual flow controls are designed to for dry, average and wet years.

No spring rise if system storage level is below 31 MAF. Flow exceeding flood control targets are the stop protocols. The natural change of water availability will result in corresponding variability.
Water availability is addressed by the 15 March system storage, which dictates the service level. System storage is largely a function of antecedent years plus precipitation up to March 15. Dry

e. Volume of water used: Volume is 0.36 MAF for a single mode rise and 0.71 MAF for a dual mode rise.

f. Level of and purposes for flexibility in its annual application (What is the intended flexibility given to USACE in its application of this proposal?):

USACE would have the flexibility in utilizing tributary flows to reach service level targets. USACE would have the flexibility to increase discharges for the purpose of evacuating water from the system to develop potential reservoir storage to prepare flood storage in the reservoirs. USACE would have the flexibility to use short term flood forecasts, which include antecedent conditions, to modify discharges to reduce likelihood of potential flooding. USACE would have the flexibility to address unforeseen emergency flow conditions.

2. **Hydrograph chart (with sideboards visually noted):** See Figure 1 for a typical Single Mode Spring Rise. See Figure 2 for a typical Dual Mode Spring Rise.

3. **Science: What is the scientific principle or hypothesis?** The Amended Biological Opinion has assumed that a hydrograph that better mimics the "natural" hydrograph is needed to recover the pallid sturgeon, the least tern, and the piping plover. The Amended Biological Opinion expanded the spring rise to include the historic March rise as well as the June rise. To apply the "natural" hydrograph paradigm to the mainstem of the Missouri River from Gavins Point to the Platte River and expect positive results generally requires the following assumptions:
* The hydrologic elements, including volume of water, biology, water chemistry, sediment, and turbidity of the tributaries are not the essential or controlling factors in the ecosystem of the Missouri River for the pallid sturgeon, which is unproven.
* That pallid sturgeon, which are ready and capable to spawn, will be available in the reach at the correct time. (This is unproven.)
* Magnitude of flow is the controlling factor for spawning of pallid sturgeon. (This is unproven.)
* Nutrients, food, turbidity, and suitable spawning substrate are available in adequate quantities in the reach at the correct time. (this is , which is unproven.
* That successful spawning in the mainstem will result in recruitment of the pallid sturgeon. (This is unproven.)

Finally, if the above assumptions can all be met, one must consider if the assumption that the "Natural" hydrograph was a good hydrograph for the pallid sturgeon. (This is unproven.)

Not withstanding the above, an alternative is presented herein. The alternative, if adequately monitored would test if one or both of the modes of the spring rise could cue the spawning of the pallid sturgeon. After each spring rise, all information will be analyzed completely, after which the adequacy of the completed spring rise as well as the need for additional spring rises will be evaluated. All additional spring rises proposed will be justified by independent science.

4. Anticipated effects

a. Proposal's anticipated effects on, or benefits to, Pallid Sturgeon (how does it assist in flow, timing, temperature, photoperiod, compare with historic hydrograph, comparison with historic flow percentiles, etc):

First rise corresponds well with the historic March rise at Sioux City, which typically started March 15 with a standard deviation of 13 days. Temperature on March 15 can be expected to be about 8 deg. C, well below the seemingly optimal temperature of 18 deg. C and also well below the typical reported spawning temperature range of 15 to 25 deg. C. However, it has been speculated that the first rise is important in cleaning the spawning substrate and or triggering adult pallid sturgeon to aggregate at spawning sites. Based on historical observations of spawning runs of sturgeon in the Missouri River Basin, it is estimated that minimum photoperiod is about 13 hours, which occurs about the first week in April at Sioux City. Thus, the first spring rise is likely outside of both the temperature and photoperiod spawning ranges at Sioux City. However new information for the Lower Yellowstone River a March rise with a generally declining hydrograph resulted in shovelnose sturgeon spawning. Thus, a single March rise below Gavins Point could be tested.

Second Rise: The June rise typically started about May 15 at Sioux City with a standard deviation of 13 days. The typical date of 18 deg. C for three consecutive days at Sioux City is about May 26 with a standard deviation of 18 days. Thus, the start date of June 1 would, in general, occur after the temperature reached 18 degrees. Recent information suggests that spawning of sturgeon may at least sometimes occur before the second rise. Based on historical observations of the photoperiod of spawning sturgeon in the Missouri River Basin it is estimated that minimum photoperiod is about 13 hours, which occurs about the first week in April at Sioux City. Thus, the second rise starting on June 1 would generally meet the minimum photoperiod criteria. However, the actual starting date can be adjusted to reflect the actual antecedent water temperature conditions

b. List the anticipated negative environmental effects (for example, terns and plovers, native fish, flood plain lakes and wetlands,)

The second rise in June could result in a large take of terns and plovers. However, if the Corps uses fluctuating water levels prior to June 1 to discourage nesting, the take may be reduced. All flood pulses aggravate streambed degradation. Streambed degradation results in a more incised river and loss of

sandbar areas in the "unchannelized" reach between Ponca and Gavins Point Dam. Streambed degradation results not only in loss of connection to chutes and backwaters but also dewatering of alluvial floodplain lakes and wetlands. However, the magnitudes of the pulses in this proposal are not large and are for short durations. Thus, this proposal would tend to minimize the additional negative environmental and economic effects of streambed degradation resulting from any spring rise.

c. **Proposal's anticipated effects on, or benefits to, socio-economic factors (how does this Proposal appear to affect water used in the basin, how do flows attenuate, effect on reservoir levels, navigation impacts, what modeling helps understand the effects):** The relatively small spring pulses proposed should typically have minimal flooding potential and or negative interior drainage potential. In addition, the "low peak-type pulses from Gavins Point Dam should attenuate to at least some degree as they proceed downstream. The total volume needed to create the pulses is small (0.071 MAF). However, both rises are at in opportune times as related to efforts to increase or at least stabilize water levels in the reservoirs during the reservoir fish spawning season. However, in non-drought years, the effect of the small pulses would be expected not to cause any problem. In general, the pulses will not have a negative effect on navigation except on years when the navigation season is shortened. No modeling has been done on the alternative proposed herein.

d. **Proposal's anticipated effects on, or benefits to, historic, cultural and burial sites (how does this Proposal appear to affect historic, cultural and burial sites in the basin, what modeling helps understand the effects):** The alternatives are not expected to have any significant additional affect on burial sites along the reservoirs as compared to present water control plan.. In general, the alternative proposed herein would not likely result in significant increases of negative or positive effects that exist with the present water control plan. The cultural resources should be evaluated at this time.

3. Brief description of monitoring methods and indicators:

a. What are the key indicators to be monitored?

b. Pending creation of MRRIC, what interim processes should be used to monitor this proposal?

Population assessment including collection of sturgeon larvae should continue. Sturgeon larvae should be described in detail and identified as to species. Monitoring of activities of "ripe" surrogate shovelnose sturgeon should continue.
Fixed station monitoring should minimally include, flow, stage, temperature, dissolved oxygen, turbidity, sediment, chlorophyll, endocrine disrupters, total trace elements, dissolved and particulate organic carbon. Productivity indicators should also be monitored, especially condition of substrate in relation to periphyton and diatoms. An additional NASQAN station just downstream of Gavins Point Dam, such as at Yankton, should be added. Other new NASQAN stations should be initiated at St. Joseph, Waverly, and Boonville. Monitoring of water from the

tributaries is likely more important than mainstem monitoring and must be initiated. This information will help evaluate a basic assumption in the Biological Opinion that the changes of population of the pallid sturgeons are due to changes to the mainstem by the USACE. This assumption has not been evaluated and its resolution may be crucial to the recovery of the pallid sturgeon. Monitoring of stream bed degradation and planform changes in the Gavins Point to Platte River reach are needed. Conversely monitoring of streambed aggradation resulting form the spring rises, in general below the Platte River mouth, is needed.

4. Advantages of this alternative.

***The Master Manual flow control considers dry, average and wet conditions in relation to system storage. Additionally other Master Manual guides control flooding, reservoir operation and other factors that are related to the Congressionally authorized uses as well as the Endangered Species are already in place. Spring rises can be built upon these Master Manual controls with minimal modification.**

*** The alternative can be used with adaptive management to obtain experimental information. This alternative is very flexible and allows for modification based on science as justified by independent science process.**

*** The plan requires minimal water use.**

*** Plan offers quick rises and falls to minimize flood pulses.**

*** The plan minimizes streambed degradation and the numerous negative economic and environmental impacts.**

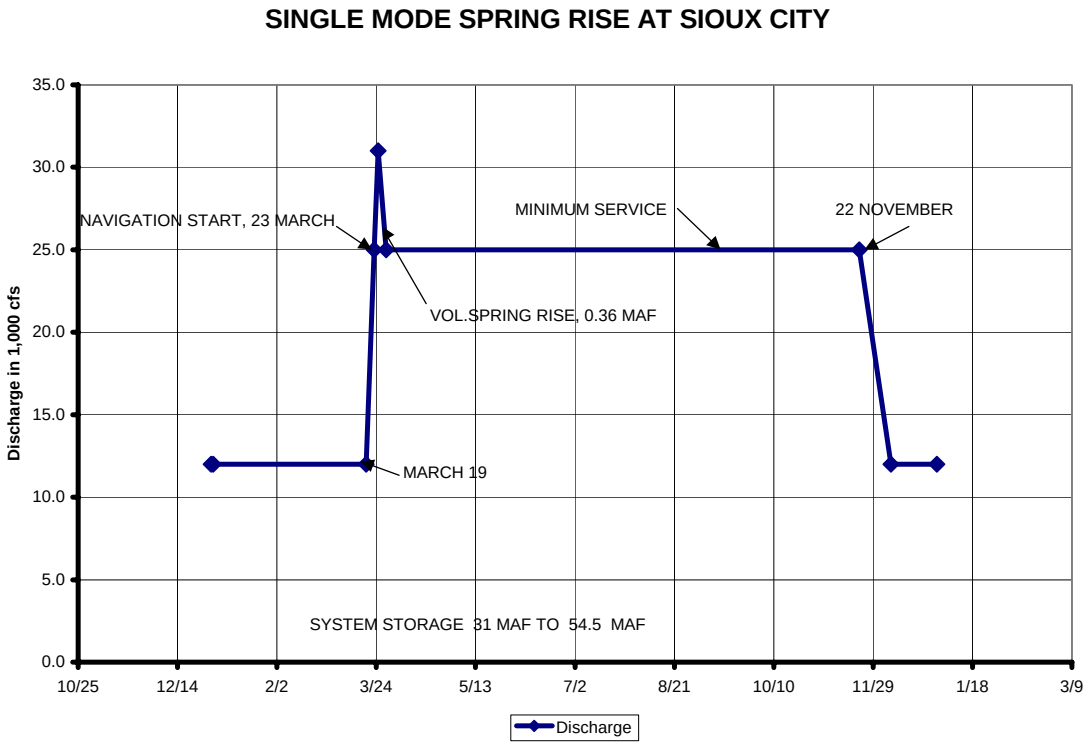

Figure 1. Single Mode Spring Rise for the Missouri River at Sioux City, Iowa. Minimum service is provided if the March 15 system storage equals or exceeds 31.0 maf and is less 49.0 maf. (Prorated service level is provided if system storage is between 49.0 and 54.5 maf.) An eight month navigation season is provided if a 1 July system storage check value equals or exceeds 51.5 maf.

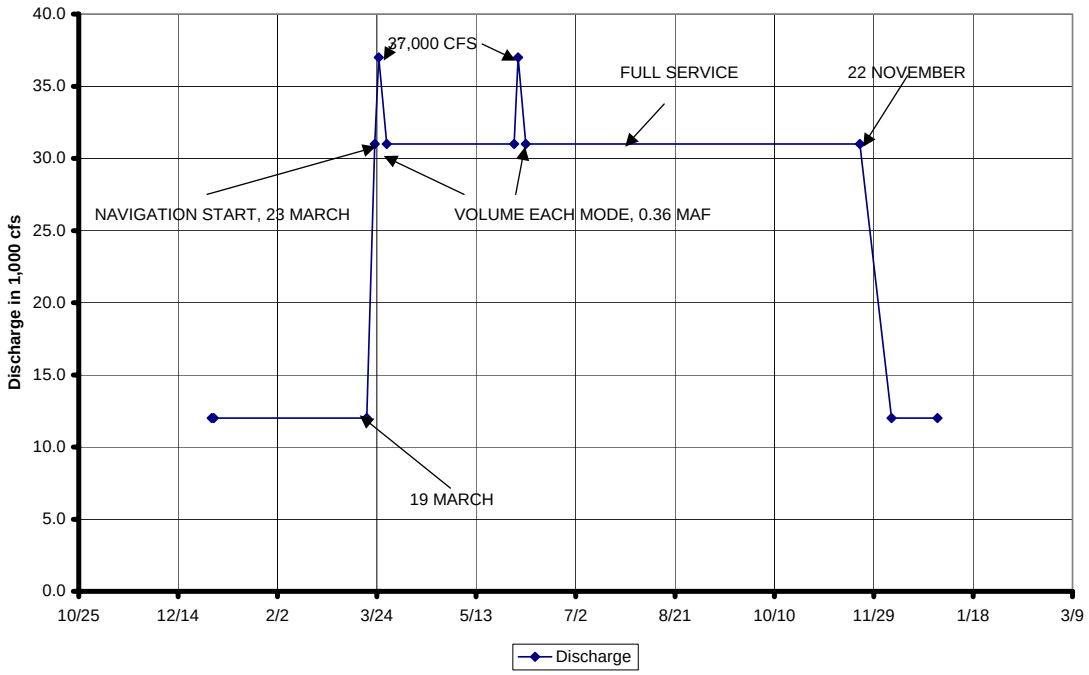

Figure 2. Dual Mode Spring Rise for the Missouri River at Sioux City, Iowa. Full service level is provided if the March 15 system storage is equal or greater than 54.5 maf, (Prorated service is provided between 54.5 49.0 maf.) An eight month navigation season is provided if the 1 July system storage equal or greater than 57..0 maf.

Natural Hydrograph proposal

1. **Description of the Proposal:**
   a. **Number of Rises:**
      i. Two rises is the acceptable model. Two peaks mimic the natural hydrograph on the targeted reach. The pallid tech working group generally favors this option.
      ii. One rise is generally not acceptable
   b. **Flood Control Targets/constraints:**
      i. Add all the spring rise to flood control constraints.
      ii. Mitigation of any downstream impacts will be identified by the affected stakeholders. Long term mitigation measures should be addressed during the MRRIC process.

   c. **Timing, duration, magnitude, rise and fall rates of First Rise:**
      i. Try to follow the timing of the historic hydrograph to the greatest extent possible. (approximately use the 50 percentile of the spring rise as start date)
      ii. Duration Rise and Fall
         - Rise rapidly
         - Peak not Plateau
      iii. Magnitude
         - Use winter flow level plus 30 kcfs

   d. **Timing, duration, Magnitude of Flow Between Rises:**
      i. Reflects timing from natural hydrograph and magnitude by navigation service level.
      ii. Release plan
         - Flat release
         - Flow to target
   e. **Timing, duration, magnitude, rise and fall rates of Second Rise:**
      i. Timing
         - Try to follow the timing of the historic hydrograph to greatest extent possible. Which includes pallid technical groups proposal of 16° C temperature initiation regime

      ii. Duration and fall rates
         - Rise rapidly as possible
         - Drop by at least 30% then draw out declining limb
         - Peak not plateau

      iii. Magnitude
         - Use service level + max allowable release by NEPA in Master Manual (30kcfs) There is a question whether a 30K cfs release is authorized under NEPA for consecutive years. It is believed that this type of release is authorized for one of every three years. For the second Rise:

1. We propose a 30K cfs release above service levels for 2006
2. A return to a first rise peak that reflects 26K cfs release outlined in a 50th percentile dates: 50th percentile pulse framework taken from the lower third of the annual runoff for years 2007 and 2008
3. A return to to a 30K cfs release above navigation service level in 2009

f. How does this address water availability? Variation for wet, normal or dry years (including Stop Protocols or precludes):

i. Follow forecast runoff for wet and dry years. Whatever is coming into the system is going out again.

ii. Above 58.5 MAF of storage on March 15th means system will be evacuation mode. COE will plan storage evacuation during the time of year to coincide with the natural hydrograph.

g. Volume of water used:

i. Greater than 1.512 MAF and Less than 3.84 MAF. This volume has yet to be calculated. We are using the values between the .50 % and .75% in the Normative table lower third.

h. Level of and purposes for flexibility in its annual application (What is the intended flexibility given to USACE in its application of this proposal?:

- The COE will be allowed flexibility to make releases from Gavins Point that approximate the 75% of the lower third of the normative hydrograph.

2. Hydrograph chart (with sideboards visually noted):

See attached Figure 1.

3. Rationale for the proposal:

a. Biological
b. Socio-economic
c. Other:

i. This proposal supports the purpose and intent of the Wild and Scenic Rivers Act for the preservation and protection of the free flowing condition of selected rivers. Specifically, Section 10a of the Act directs federal agencies to protect and enhance the free flowing condition and Outstandingly Remarkable Values of selected rivers.

4. **Anticipated effects (positive or negative)**
    a. Proposal's anticipated effects on, or benefits to, Pallid Sturgeon (how does it assist in flow, timing, temperature, photoperiod, compare with historic hydrograph, comparison with historic flow percentiles, etc):
        i. This proposal re-creates the natural hydrograph under the constraints of current NEPA under the Current Water Control Plan.
        ii. Additionally, this proposal takes into account many of the recommendations of the pallid sturgeon technical group.
            - Follows natural temperature pattern relating to the first rise recommendation by the pallid technical committee.
            - The first of the bi-modal rise provides a habitat conditioning scenario and biological queue for migration and spawning
            - The second of the bi-modal rise would serve as the dispersal mechanism for the subsequent larval stages into appropriate rearing habitats.

        iii. Potential negative impacts to the piping Plover should be noted. Due to the conditioning of piping plover to search for nesting habitats earlier in the year the second rise has the possibility of flooding out some plover nests. However, these birds are capable of re-nesting later on in the season or they have the potential to move to other systems natural flowing systems where habitat is available, like the Niobrara River.

    b. Proposal's anticipated effects on, or benefits to, socio-economic factors (how does this Proposal appear to affect water used in the basin, how to flows attenuate, effect on reservoir levels, navigation impacts, what modeling helps understand the effects):
        i. mitigated impacts for downstream users
        ii. fluctuation of reservoir levels will be reduced
        iii. If supplemental water is needed under low water conditions, water allocated for this proposal will be pro-rated from other all other resource users.
    c. Proposal's anticipated effects on, or benefits to, historic, cultural and burial sites (how does this Proposal appear to affect historic, cultural and burial sites in the basin, what modeling helps understand the effects):
        i. Keeps reservoir at flat level and reduces fluctuations for cultural resource stabilization.

5. **Brief description of monitoring methods and indicators:**
    a. What are the key indicators (whether positive or negative) to be monitored?
        i. Implementation of a USGS gage site below the Gavins Point Dam should be considered
        ii. Continued support from the Corps of Engineers on monitoring programs involving pallid sturgeon and the surrogate shovelnose sturgeon
        iii. Increase funding for other aquatic research at a more ecosystem level including:

- ♦ The impacts of Large Woody Debris as habitat forming mechanisms
- ♦ The role nutrients in the mainstem of the Missouri River.
- ♦ Investigating solutions on how to transport sediment from up stream of Gavins point to below the dam.

b. Pending creation of MRRIC, what interim processes should be used to monitor this proposal?

6. **Description of mitigation measures for the down stream stakeholders:**
   a. Corps of Engineers purchasing pumps to evacuate water above drainage flaps to mitigate for lost drainage capability during high water events.
   b. Re-engineering drainage canals, floodgates, and ditches to handle high water events during potential spring rises.
   c. Initiate the mitigation program by purchasing flooding easements along the Missouri River corridor.
   d. Corps of Engineers pursuing a Land acquisition program from willing landowners for conservation and floodplain development purposes in high priority affected areas (Nebraska City Area).

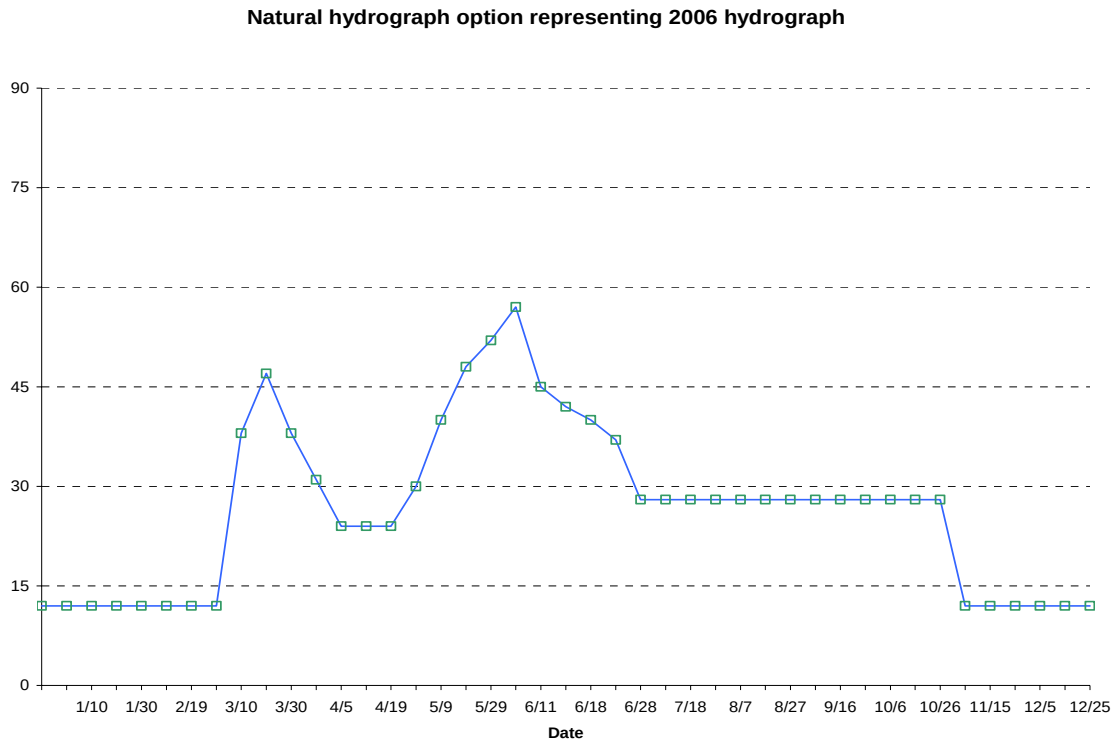

Figure 1. Chart showing Natural Hydrograph option 2006 flow scenario.

Multiple Use Alternative

1. Description of the Proposal:
    a. Number of Rises:
        i. One/Two depending on storage conditions. Have no spring rises when system storage is below 31.0 MAF, a single rise from 31.0 to 34.0 MAF, and two rises between 34 and 58.5 MAF. Above 58.5 MAF evacuation will be occurring and no spring rise should occur.
    b. Flood Control Targets/constraints:
        i. Minimal modification of the flood control constraints during the Spring Rise timing.
    c. Timing, duration, magnitude, rise and fall rates of First Rise:
        i. Timing
            1. Begin first rise to coincide with start of navigation support releases from Gavins Point.
        ii. Duration and rise and fall rates
            1. Rise up to 6,000 cfs/day.
            2. 2 day peak.
            3. Fall 4,000 cfs first day, then prorate the drop of the remainder of the descending limb so the total length of the rise from initiation to end is approximately 16 days
        iii. Magnitude
            1. Prorate between the +22,000 cfs and the minimum rise.
            2. Have an absolute flow cap of 35,000 cfs at Gavins Point.
    d. Timing, duration, magnitude of Flow Between Rises:
        i. Guided by the master manual
            1. Release plan (may only be necessary under certain plans when the second rise occurs after late May)
                a. Flat release only during evacuation
                b. Flow to target other times
    e. Timing, duration, magnitude, rise and fall rates of Second Rise:
        - Below 31.0 MAF storage, no rise. Between 31.0 and 54.5 MAF the rise is prorated. Between 54.5 and 58.5 there will be a full rise. Above 58.5 there will not be specific releases for a spring rise because system will be evacuating water.
        i. Timing
            1. As late as possible - must consider the bird species and avoid unacceptable levels of take.
        ii. Duration and rise and fall rates
            1. Rise up to 6,000 cfs per day.
            2. 2 day peak.
            3. Drop first two days at 4,000 cfs/day, then prorate the drop of the remainder of the descending limb so the total length of the rise from initiation to end is between 21 to 28 days.
        iii. Magnitude
            1. Prorate between 20,000 cfs and the minimum rise.

2. Have an absolute cap of 48,000 cfs.

f. How does this address water availability? Variation for wet, normal or dry years (including Stop Protocols or precludes):
    - March 15th storage check will set the number of peaks and their magnitude.
    - This alternative is based upon navigation support and drought conservation listed in the current water control master manual (NWCP00).

g. Volume of water used:
    - The volume will range from the minimum peak to 0.5 MAF (estimated)

h. Level of and purposes for flexibility in its annual application (What is the intended flexibility given to USACE in its application of this proposal?):
    - The Corps should use all forecasting abilities to reduce flooding.
    - The Corps should have the ability to react to unexpected events during the spring rise period.
    - As more tern and plover habitat is created, the spring rise may be shifted later into June.
    - Proposed flow rates could be targeted immediately below the James River confluence. This would require a new gaging site to be established at this site. Monitoring at this site could include flow rate and water temperature.

2. Hydrograph charts (with sideboards visually noted): Figures 1, 2, & 3.

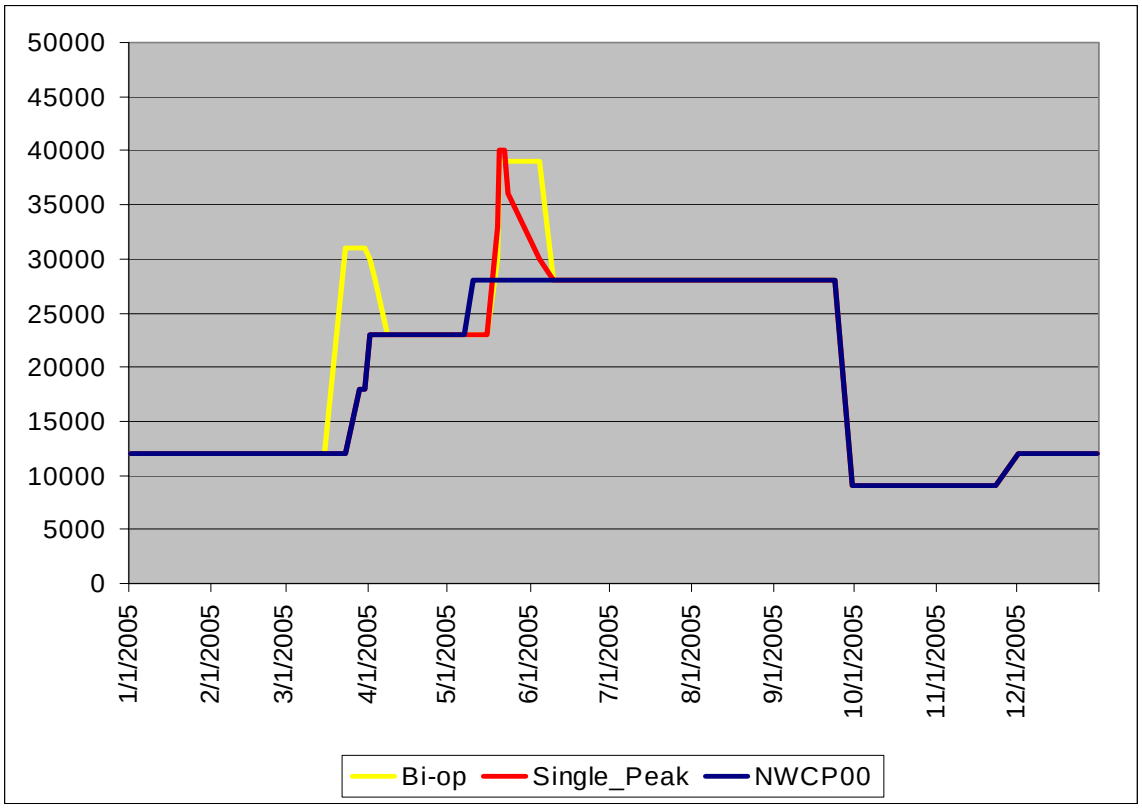

Figure 1. Single modal rise under extreme low system storage conditions, navigation support and drought conservation utilize current water control master manual guidelines.

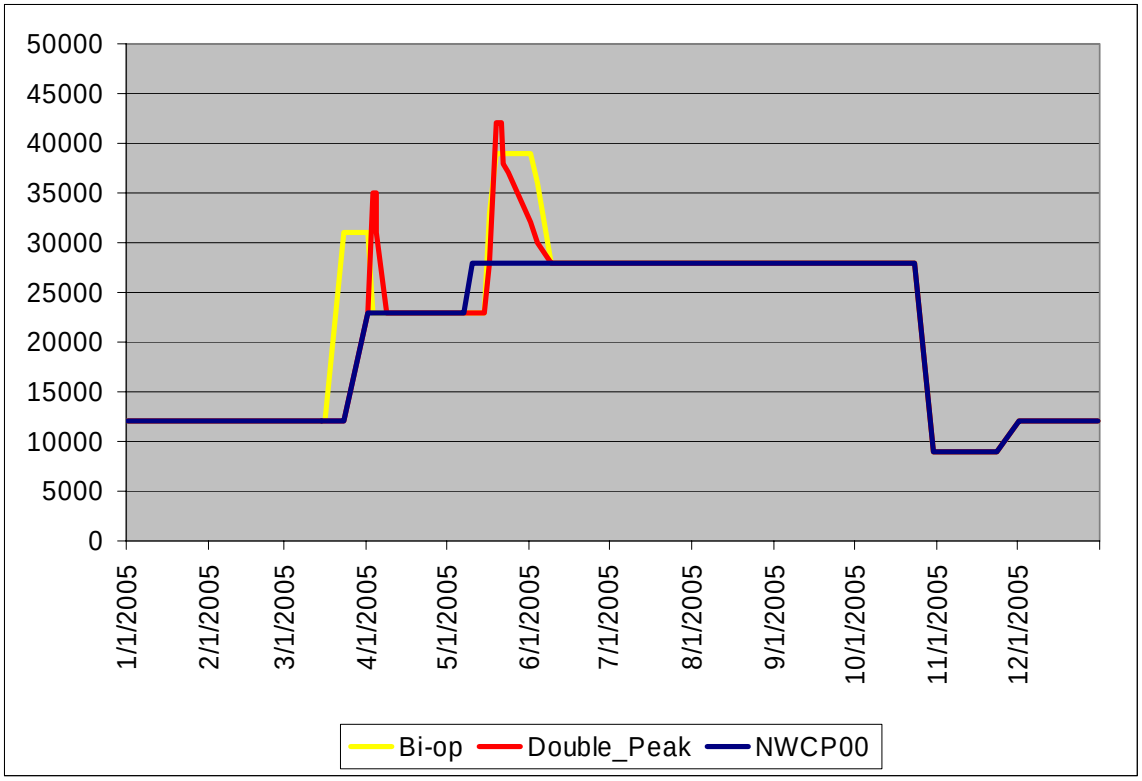

Figure 2. Double modal rise under low system storage conditions navigation support and drought conservation utilize current water control master manual guidelines.

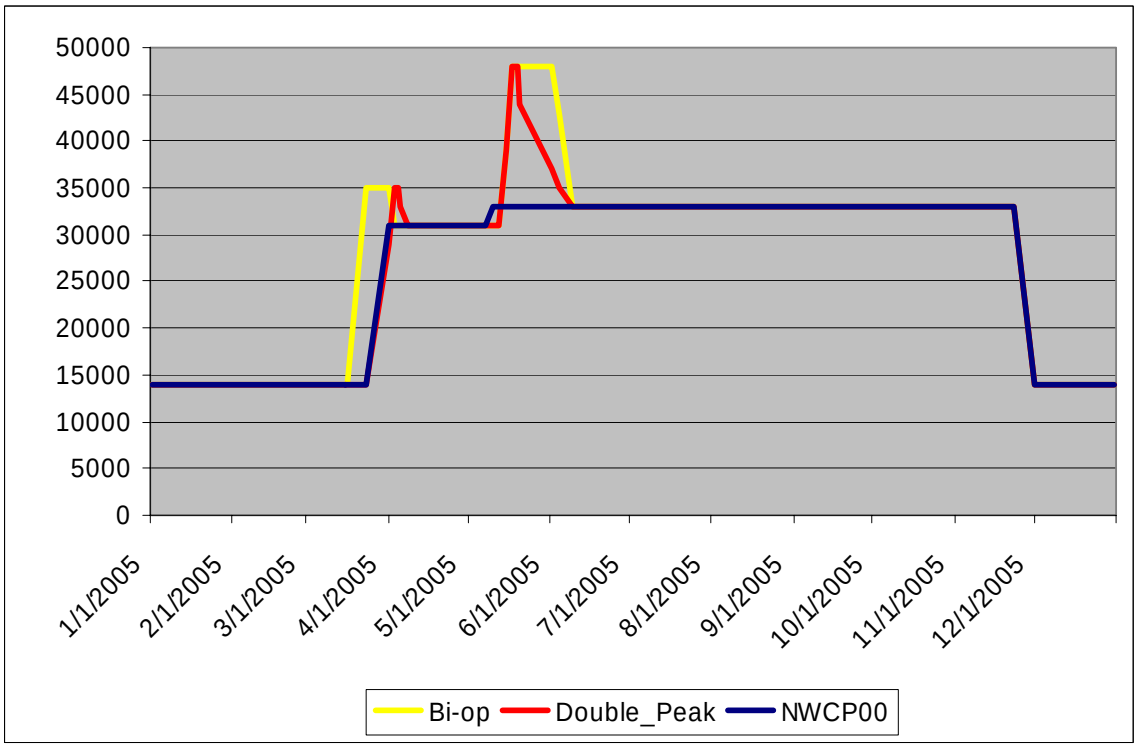

Figure 3. Double modal rise under normal system storage conditions navigation support and drought conservation utilize current water control master manual guidelines.

3. Rationale for the proposal:
    a. Biological: This alternative mimics the timing of the natural hydrograph based upon the lower third of the historic runoff data. Factored into this alternative is consideration for the nesting requirement of the least terns and piping plovers.
    b. Socio-economic: This plan utilizes peak rather than plateau shaped rises. Some advantages over the default plan are utilization of less water for the rises during periods of low system storage. This alternative also uses peaks to lessen the potential downstream flooding effects for flood plain farmers. The foundation for this alternative is based upon the current master manual relative to navigation support and drought conservation.
    c. Other: This plan attempts to balance the need for creating a more positive natural environment for the pallid sturgeon while considering nesting habitat and timing for the least tern and piping plover, with the other authorized project purposes
4. Anticipated effects (positive or negative)
    a. Proposal's anticipated effects on, or benefits to, Pallid Sturgeon (how does it assist in flow, timing, temperature, photoperiod, compare with historic hydrograph, comparison with historic flow percentiles, etc): This alternative suggested timing for the spring rise pulses are based upon historic natural flow data taking into account water temperature and the photoperiod conditions hypothesized to be needed to create a positive environment to induce spawning in pallid sturgeon.
    b. Proposal's anticipated effects on, or benefits to, socio-economic factors (how does this Proposal appear to affect water used in the basin, how to flows attenuate, effect on reservoir levels, navigation impacts, what modeling helps understand the effects): This alternative as compared to the default spring rise plan utilizes peak shaped rises with a fairly steep ascending limb, short duration top and initial sharp descending limb for a short time period followed by a protracted decline for the remainder of the descent period. This plan relative to the default plan should reduce the potential for negative effects for flood effect downstream flood plain farming. Also compared default plan, this alternative reduces the total amount of water required to provide for the spring rise(s) benefiting total system storage in the mainstem which provides benefits to reservoir water supply intakes, inundated cultural resource sites along the reservoirs, reservoir recreation and reservoir habitat for fish production.
    c. Proposal's anticipated effects on, or benefits to, historic, cultural and burial sites (how does this Proposal appear to affect historic, cultural and burial sites in the basin, what modeling helps understand the effects): By reducing the amount of water drafted from the reservoirs, cultural resource sites originally flooded when the reservoirs filled stand a better chance of remaining flooded which protects them from being uncovered by wave action and potential bank sloughing. Keeping these site flooded also reduces the likelihood of possible looting.

5. Brief description of monitoring methods and indicators:
    a. What key indicators (whether positive or negative) are to be monitored?

Intense monitoring of the pallid sturgeon population should be performed to determine if the proposed alternative is providing the need queues to induce spawning. Monitoring of the effects, both positive an negative, to the authorized project purposes.

b. Pending creation of MRRIC, what interim processes should be used to monitor this proposal? Continue the several existing biological monitoring programs, the Corps should collect this information then distribute the data to the various stake holders including the individuals who participated in both the technical and plenary portions of this process.